

MTH1126 - FINAL EXAM

Date September 9, 2026 Exam time: 120 minutes

NAME: _____

STUDENT ID NUMBER: _____

General instructions:

- No discussion is allowed in the exam room.
- No electronic devices (except calculator) are allowed.

PROBLEM	POINTS	SCORE
A1	4	
A2	4	
A3	4	
A4	4	
A5	4	
A6	4	
A7	4	
A8	4	
A9	4	
A10	4	
B1	15	
B2	10	
B3	15	
B4	10	
B5	10	
TOTAL	100	

PART A: Multiple choice or Short answer

(4 marks for each correct answer/choice)

Problem A3. Find a power series representation for

$$f(x) = \frac{1}{1-2x}.$$

Problem A4. Find the area enclosed by

$$x = t^2 + t, \quad y = t, \quad 0 \leq t \leq 2,$$

and the x -axis.

A. $\frac{22}{3}$ B. $\frac{16}{3}$ C. 8 D. A, B, C are incorrect

Problem A5. Let $r = 2 + 2 \cos \theta$. Find the slope of the tangent line at $\theta = \pi/3$.

A. 0 B. 1 C. -1 D. A, B, C are incorrect

Problem A6. Find the positive r such that

$$\sum_{n=2}^{\infty} (-1)^n r^n = \frac{1}{6}.$$

Answer (exact value): _____

Problem A7. Find

$$\sum_{n=1}^{\infty} \frac{3}{n(n+3)}.$$

Answer (exact value): _____

Problem A8. Find the foci and asymptotes of

$$25x^2 - 9y^2 = 225.$$

Foci: _____ Asymptotes: _____

Problem A9. Find an equation of the ellipse with foci $(0, \pm 4)$ and vertices $(0, \pm 5)$.

Answer: _____

Problem A10. Find

$$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n3^n}.$$

A. $\ln \frac{4}{3}$ B. $\ln \frac{3}{2}$ C. $\ln 3$ D. Divergence

PART B: WRITE YOUR FULL ANSWERS

Problem B1. (15 points) A curve C is defined by

$$x = 2 + 4 \sin t, \quad y = 3 \cos t.$$

(a) Find the points where $x = 4$, and the slope at the first-quadrant point.

(b) Find all points where the tangent is horizontal or vertical.

(c) Let R be the part of the interior of C in the first quadrant. Set up integrals for the volumes obtained by rotating R about the x -axis and about the y -axis. Do not evaluate.

Problem B2. (10 points)

(a) Prove that

$$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n+1}$$

is convergent.

(b) Approximate its sum using the first six terms and estimate the error.

Problem B3. (15 points) Find the radius and interval of convergence of

$$\sum_{n=1}^{\infty} \frac{4^{n+1}(x-2)^n}{3n+1}.$$

Problem B4. (10 points) Solve

$$xy'' + 3y' = 16x^2, \quad x > 0,$$

using the substitution $u = y'$.

Problem B5. (10 points) Find the sum of

$$\sum_{n=0}^{\infty} \frac{(x-1)^n}{(n+2)!}.$$

Express the result using elementary functions.

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